Fact Sheet

CLUTTER STATISTICS OF WET SNOW COVER MEASURED WITH AN FMCW RADAR (32–35 GHz)

BACKGROUND

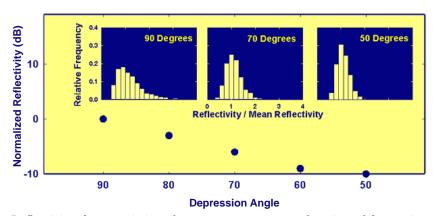
Snow-covered terrain represents a high-clutter environment for radar sensors. Because of the spatial and temporal variations in snow-cover properties, radars operating in a winter environment can encounter varying clutter statistics. Measurements have been initiated to determine the reflectivity characteristics of snow-covered terrain using an FMCW radar operating at 32–35 GHz. The relatively high bandwidth allows us to resolve the dominant scattering mechanisms in a snow cover and also allows us to investigate the effect of frequency-averaging on clutter statistics. Our initial analysis is limited to wet snow cover where surface scattering is the dominant scattering mechanism.

EXPERIMENT

Backscatter measurements from wet snow cover were made using an FMCW radar operating at 32-35 GHz bandwidth. The radar was mounted on a gantry that traversed a $10-m \times 15-m$ plot of undisturbed snow. The radar was located 3.3 m above the ground. The backscatter data were collected at depression angles from 90 to 50 degrees in 10-degree increments. Typical backscatter results from a wet snow cover are illustrated in the following figure.

RESULTS

For a wet snow cover, a 10-dB reduction in reflectivity can be expected as the radar depression angle decreases from 90 to 50 degrees. The width of probability density function (PDF) normalized to the mean reflectivity will also decrease as the depression angle decreases. (The width of the normalized PDF will increase as the radar bandwidth decreases because of reduced frequency averaging.) For wet snow, the frequency-averaged PDFs were successfully fitted with



Reflectivity characteristics of a wet snow cover as a function of depression angle obtained with an FMCW radar operating at 32–35 GHz bandwidth.

Rayleigh statistics and successive convolutions of Rayleigh statistics. The analysis of clutter statistics from dry snow cover will be complicated by the volume scattering contributions from individual snow grains as well as the reflections from layers within the snow cover.

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